SOLAR/1057-79/04

Monthly Performance Report

ZIEN MECHANICAL CONTRACTORS NO. 1

APRIL 1979

U.S. Department of Energy

National Solar Heating and Cooling Demonstration Program

National Solar Data Program

MONTHLY PERFORMANCE REPORT

ZIEN MECHANICAL CONTRACTORS NO. 1

APRIL 1979

I. SYSTEM DESCRIPTION

Zien Mechanical Contractors No. 1 is a single-family residence in Milwaukee, Wisconsin. The home has approximately 1304 square feet of conditioned space. The solar energy system consists of two independently controlled systems: One system serves domestic hot water (DHW) preheating, the other is used for space heating and space cooling. Only the space heating and cooling system is described in this report.

The system has an array of flat-plate collectors with a gross area of 384 square feet. The array faces south at an angle of 53 degrees to the horizontal. Air is the transfer medium that delivers solar energy from the collector array to storage. Solar energy is stored in a rock bin containing 41,250 pounds of rock located in the basement of the house. The rock bin has 2 inches of polyurethane insulation on the outside walls and fiberglass roll insulation in the ceiling. A heat pump delivers solar energy from storage to a heat exchanger located within an air-handler. Heated air is then blown from the air-handler to the load. When solar energy is insufficient to satisfy the space heating load, an electric resistance heater in the air-handler provides auxiliary energy for space heating. The system, shown schematically in Figure 1, has 10 modes of solar operation for space conditioning.

Mode 1 - Storage-to-Heat Pump-to-Space Heating: This winter mode activates when there is a demand for space heating, the collector loop is not active, and the outside ambient temperature is less than 10°F above the rock bed temperature. Air is drawn through motorized dampers from storage by the collector/heat pump circulating fan, goes past the heat pump evaporator coil, bypasses the collector, and returns to storage. The heat pump condenser coil and house circulating fan supply energy to the house and electrical strip heaters supplement the heat pump to meet the heating demand.

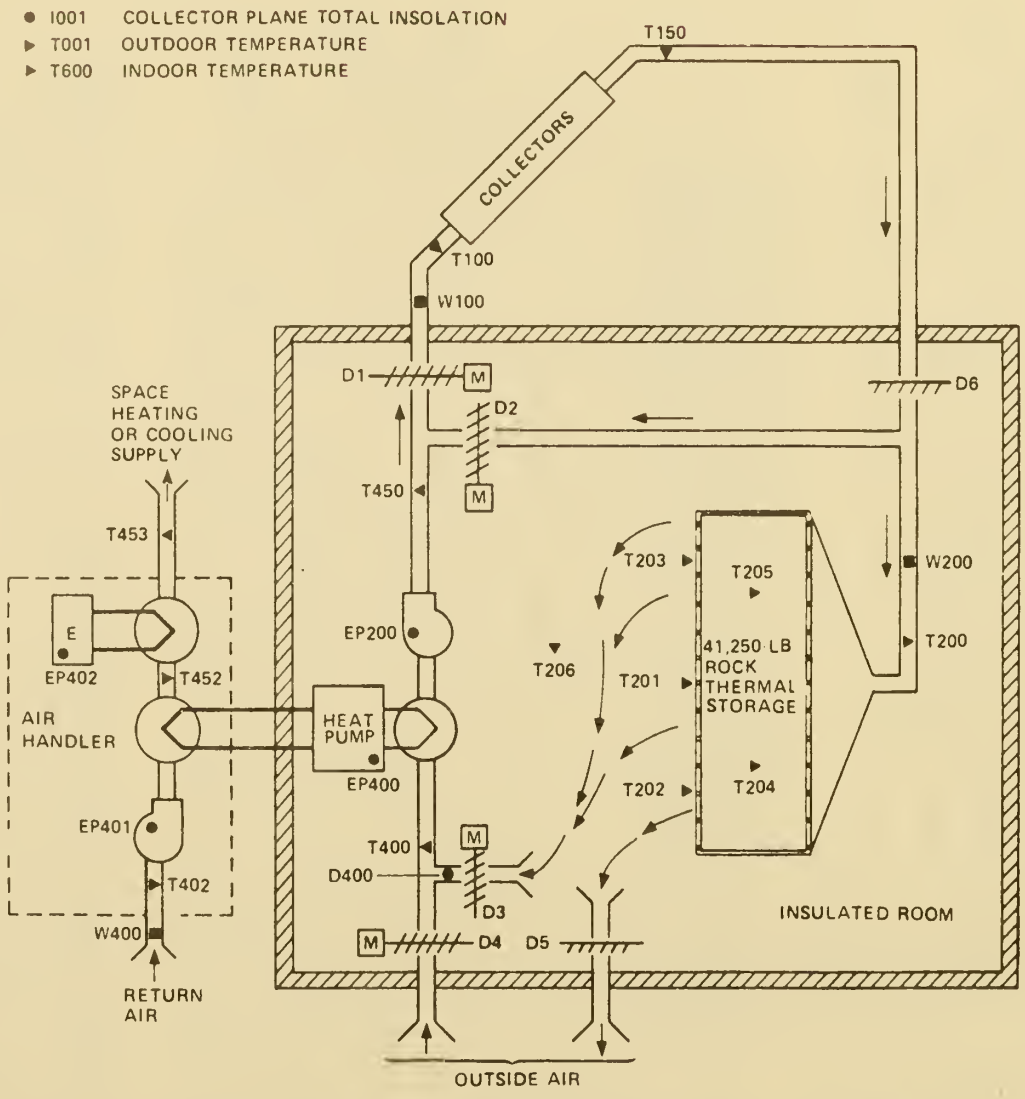

Figure 1. ZIEN MECHANICAL NO. 1 SOLAR ENERGY SYSTEM SCHEMATIC

Mode 2 - Collector-to-Storage: This winter mode activates when the temperature difference between the collector outlet and storage is 10°F or higher, and the outside ambient temperature is less than 10°F above the rock bed temperature. Air is drawn from the collector by the collector/heat pump circulating fan, goes into the rock bin through motorized dampers, and then recirculates through the collector. There may or may not be a demand for space heating.

Mode 3 - Outside Air-to-Rock Bed: This mode activates when the collector loop is inactive, there is no demand for space heating, and the outside ambient temperature is higher than 10°F above the rock-bed temperature. Air is drawn from the outside by the collector/heat pump circulating fan, goes into the rock bin through motorized dampers, and then exhausts to the outside through a backdraft damper in the wall of the insulated room.

Mode 4 - Outside Air-to-Heat Pump-to-Space Heating: This winter mode activates when there is a demand for space heating, the collector loop is not active, and the outside ambient temperature is more than 10°F above the rock bed temperature. Air is drawn from the outside through motorized dampers, passes the heat pump evaporator coil, goes through the storage bin, and then exhausts to the outside through a backdraft damper in the wall of the insulated room. The heat pump condenser coil and house circulating fan supply energy to the house. Electric strip heaters supplement the heat pump to meet the heating demand.

Mode 5 - Outside Air-to-Collector-to-Rock Bed: This mode activates when the difference in temperature between the collector outlet and storage is 10°F or higher, and the outside ambient temperature is more than 10°F above the rock bed temperature. Air is drawn from the outside by the collector/heat pump circulating fan, goes through the collector and into the rock bin through motorized dampers, and then exhausts to the outside. There may or may not be a demand for space heating.

Mode 6 - Storage-to-Heat Pump-to-Space Cooling: This summer mode activates when there is a demand for space cooling, the collector loop is not active,

and the rock bed temperature is less than 10°F above the outside ambient temperature. Air is drawn through motorized dampers from storage by the collector/heat pump fan, goes past the heat pump condenser coil, bypasses the collector, and returns to storage. The heat pump evaporator coil and house circulating fan remove energy from the house.

Mode 7 - Collector-to-Storage for Cooling: This mode rejects rock bed energy by circulating air through the collector at night. This summer mode activates when the temperature difference between the rock bed and the collector outlet is 10°F or higher, and the rock bed temperature is less than 10°F above the outside ambient temperature. Air is drawn from the collector at night by the collector/heat pump circulating fan, goes into the rock bin through motorized dampers, and then recirculates through the collector. There may or may not be a demand for space cooling.

Mode 8 - Outside Air-to-Rock Bed for Cooling: This mode activates when the collector loop is inactive, there is no demand for space cooling, and the rock bed temperature is more than 10°F above the outside ambient temperature. Air is drawn from the outside by the collector/heat pump circulating fan, goes into the rock bin through motorized dampers, and then exhausts to the outside through a backdraft damper in the wall of the insulated room.

Mode 9 - Outside Air-to-Heat Pump-to-Space Cooling: This summer mode activates when there is a demand for space cooling, the collector loop is not active, and the rock bed temperature is more than 10°F above the outside ambient temperature. Air is drawn from the outside through motorized dampers to the heat pump, passes the heat pump condenser coil, goes through the storage bin, and then exhausts to the outside through a backdraft damper in the wall of the insulated room. The heat pump evaporator coil and house circulating fan remove energy from the house to meet the cooling load.

Mode 10 - Outside Air-to-Collector-to-Rock Bed: This mode activates when the temperature difference between the rock bed and collector outlet is 10°F or higher, and the rock bed temperature is higher than 10°F above the outside ambient temperature. Air is drawn from the outside by the collector/heat

pump circulating fan, goes into the rock bin through motorized dampers, and then exhausts to the outside. There may or may not be a demand for space cooling.

II. PERFORMANCE EVALUATION

INTRODUCTION

The site was unoccupied in April; however, the solar energy system operated continuously during the month. Solar energy satisfied 62 percent of the space heating requirement. The solar energy system provided an electrical energy savings of 2.3 million Btu.

WEATHER CONDITIONS

During the month, total incident solar energy on the collector array was 12.8 million Btu for a daily average of 1114 Btu per square foot. This was below the estimated average daily solar radiation for this geographical area during April of 1412 Btu per square foot for a south-facing plane with a tilt of 53 degrees to the horizontal. The average ambient temperature during April was 42°F as compared with the long-term average for April of 45°F. The number of heating degree-days for the month (based on a 65°F reference) was 677, as compared with the long-term average of 609.

THERMAL PERFORMANCE

Collector - The total incident solar radiation on the collector array for the month of April was 12.8 million Btu. During the period the collector loop was operating, the total insolation amounted to 10.7 million Btu. The total collected solar energy for the month of April was 5.0 million Btu, resulting

in a collector array efficiency of 39 percent, based on total incident insolation. Solar energy delivered from the collector array to storage was 5.0 million Btu. Operating energy required by the collector loop was 0.50 million Btu.

Storage - Solar energy delivered to storage was 5.0 million Btu. There were 3.7 million Btu delivered from storage to the space heating subsystem. Energy loss from storage was 1.3 million Btu. This loss represented 26 percent of the energy delivered to storage. The storage efficiency was 74 percent: This is calculated as the ratio of the sum of the energy removed from storage and the change in stored energy, to the energy delivered to storage. The average storage temperature for the month was 60°F.

Space Heating Load - The space heating subsystem consumed 3.7 million Btu of solar energy and 2.3 million Btu of auxiliary electrical energy to satisfy a space heating load of 6.0 million Btu. The solar fraction of this load was 62 percent. The space heating subsystem consumed a total of 1.3 million Btu of operating energy, resulting in an electrical energy savings of 2.8 million Btu.

OBSERVATIONS

Large storage losses are attributed to leakage in the collector loop. These losses cause cold make-up air to be drawn into the insulated room through the outside vents.

ENERGY SAVINGS

The solar energy system provided a net electrical energy savings of 2.3 million Btu. The space heating subsystem contributed an electrical energy savings of 2.8 million Btu.

III. ACTION STATUS

The grantee and IBM/Boeing are expected to investigate the inflow of air through the outside vents of the insulated room and the inability to determine the temperature of the collector inlet during cold weather.

MONTHLY PERFORMANCE REPORT

ZEIN MECHANICAL CONTRACTORS NO. 1

APRIL 1979

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Mode 1 - Storage-to-Heat Pump-to-Space Heating: This winter mode activates when there is a demand for space heating, the collector loop is not active, and the outside ambient temperature is less than 10°F above the rock bed temperature. Air is drawn through motorized dampers from storage by the collector/heat pump circulating fan, goes past the heat pump evaporator coil, bypasses the collector, and returns to storage. The heat pump condenser coil and house circulating fan supply energy to the house and electrical strip heaters supplement the heat pump to meet the heating demand.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: ZEIN MECHANICAL-NO. 1 SOLAR/1057-79/04
REPORT PERIOD: APRIL,1979

SITE/SYSTEM DESCRIPTION:
THE ZEIN MECHANICAL NO. 1 SOLAR ENERGY SYSTEM UTILIZES A SOLAR ASSISTED HEAT PUMP TO HEAT AND COOL A 1304 SQ FT SINGLE FAMILY DWELLING. THE COLLECTION SUBSYSTEM CONSISTS OF 384 SQ FT OF AIR COLLECTORS, TILTED AT 53 DEGREES, TO COLLECT SOLAR ENERGY DURING THE WINTER AND REJECT HEAT PUMP COOLING ENERGY DURING THE SUMMER. A 40 TON ROCK BED IS USED FOR STORAGE. AUXILIARY HEATING IS SUPPLIED BY THE HEAT PUMP WHICH CONTAINS AN ELECTRIC STRIP HEATER.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	12.837	MILLION BTU
	33430	BTU/SQ.FT.
COLLECTED SOLAR ENERGY	4.975	MILLION BTU
	12956	BTU/SQ.FT.
AVERAGE AMBIENT TEMPERATURE	42	DEGREES F
AVERAGE BUILDING TEMPERATURE	68	DEGREES F
DCSS SOLAR CONVERSION EFFICIENCY	0.29	
DCSS OPERATING ENERGY	0.502	MILLION BTU
TOTAL SYSTEM OPERATING ENERGY	1.810	MILLION BTU
TOTAL ENERGY CONSUMED	9.069	MILLION BTU

SUBSYSTEM SUMMARY:

	DCT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	N.A.	5.979	N.A.	5.979 MILLION BTU
SOLAR FRACTION	N.A.	62	N.A.	62 PERCENT
SOLAR ENERGY USED	N.A.	3.695	N.A.	3.695 MILLION BTU
OPERATING ENERGY	N.A.	1.308	N.A.	1.810 MILLION BTU
AUX. THERMAL ENERGY	N.A.	2.284	N.A.	2.284 MILLION BTU
AUX. ELECTRIC FUEL	N.A.	2.284	N.A.	2.284 MILLION BTU
AUX. FOSSIL FUEL	N.A.	N.A.	N.A.	N.A. MILLION BTU
ELECTRICAL SAVINGS	N.A.	2.799	N.A.	2.297 MILLION BTU
FOSSIL SAVINGS	N.A.	N.A.	N.A.	N.A. MILLION BTU

SYSTEM PERFORMANCE FACTOR: 0.439

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM,FEBRUARY 28,1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: ZEIN MECHANICAL-NO. 1 SOLAR/1057-79/04
REPORT PERIOD: APRIL,1979

SITE/SYSTEM DESCRIPTION:
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GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	13.543	GIGA JOULES
	379630	KJ/SQ.M.
COLLECTED SOLAR ENERGY	5.249	GIGA JOULES
	147129	KJ/SQ.M.
AVERAGE AMBIENT TEMPERATURE	5	DEGREES C
AVERAGE BUILDING TEMPERATURE	20	DEGREES C
ECSS SOLAR CONVERSION EFFICIENCY	0.29	
ECSS OPERATING ENERGY	0.529	GIGA JOULES
TOTAL SYSTEM OPERATING ENERGY	1.909	GIGA JOULES
TOTAL ENERGY CONSUMED	9.568	GIGA JOULES

SUBSYSTEM SUMMARY:

	DCT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	N.A.	6.308	N.A.	6.308 GIGA JOULES
SOLAR FRACTION	N.A.	62	N.A.	62 PERCENT
SOLAR ENERGY USED	N.A.	3.899	N.A.	3.899 GIGA JOULES
OPERATING ENERGY	N.A.	1.380	N.A.	1.909 GIGA JOULES
AUX. THERMAL ENG	N.A.	2.409	N.A.	2.409 GIGA JOULES
AUX. ELECTRIC FUEL	N.A.	2.409	N.A.	2.409 GIGA JOULES
AUX. FOSSIL FUEL	N.A.	N.A.	N.A.	N.A. GIGA JOULES
ELECTRICAL SAVINGS	N.A.	2.953	N.A.	2.423 GIGA JOULES
FOSSIL SAVINGS	N.A.	N.A.	N.A.	N.A. GIGA JOULES

SYSTEM PERFORMANCE FACTOR: 0.439

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@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM,FEBRUARY 28,1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENERGY COLLECTION AND STORAGE SUBSYSTEM (ECSS)

SITE: ZEIN MECHANICAL-NO. 1
REPORT PERIOD: APRIL,1979

SOLAR/1057-79/04

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	AMBIENT TEMP DEG-F	ENERGY TO LOADS MILLION BTU	AUX THERMAL TO ECSS MILLION BTU	ECSS OPERATING ENERGY MILLION BTU	ECSS ENERGY REJECTED MILLION BTU	ECSS SOLAR CONVERSION EFFICIENCY
1	0.058	33	0.187	N	0.020	N	3.236
2	0.184	32	0.214	O	0.022	O	1.160
3	0.802	36	0.136	T	0.022	T	0.170
4	0.453	36	0.148		0.019		0.326
5	0.073	31	0.253	A	0.021	A	3.472
6	0.949	23	0.281	P	0.025	P	0.296
7	0.184	29	0.202	P	0.022	P	1.096
8	0.046	32	0.178	L	0.019	L	3.873
9	0.348	32	0.162	I	0.021	I	0.465
10	0.695	33	0.140	C	0.021	C	0.202
11	0.053	35	0.188	A	0.018	A	3.561
12	0.509	53	0.082	B	0.019	B	0.161
13	0.680	48	0.107	L	0.018	L	0.157
14	0.569	44	0.143	E	0.018	E	0.251
15	0.317	42	0.136		0.018		0.430
16	0.756	44	0.092		0.018		0.122
17	0.745	46	0.053		0.016		0.071
18	0.645	44	0.074		0.016		0.087
19	0.623	49	0.068		0.015		0.110
20	0.197	54	0.048		0.012		0.242
21	0.140	49	0.069		0.012		0.492
22	0.736	54	0.038		0.003		0.051
23	0.761	55	0.014		0.006		0.018
24	0.112	53	0.058		0.012		0.519
25	0.306	62	0.026		0.014		0.086
26	0.376	46	0.098		0.016		0.260
27	0.137	37	0.136		0.015		0.998
28	0.636	38	0.123		0.019		0.193
29	0.120	38	0.119		0.012		0.987
30	*	*	*		*		*
SUM	12.837	-	3.695	N.A.	0.502	N.A.	-
AVG	0.428	42	0.123	N.A.	0.017	N.A.	0.288
NBS ID	Q001	N113			Q102		N111

* DENOTES UNAVAILABLE DATA.
0 DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
COLLECTOR ARRAY PERFORMANCE

SITE: ZEIN MECHANICAL-NO. 1 SOLAR/1057-79/04
REPORT PERIOD: APRIL,1979

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	OPERATIONAL INCIDENT ENERGY MILLION BTU	COLLECTED SOLAR ENERGY MILLION BTU	DAYTIME AMBIENT TEMP DEG F	COLLECTOR ARRAY EFFICIENCY
1	0.058	0.047	0.026	34	0.443
2	0.184	0.173	0.087	32	0.473
3	0.802	0.775	0.395	44	0.492
4	0.453	0.443	0.211	40	0.465
5	0.073	0.017	0.009	38	0.130
6	0.949	0.923	0.420	26	0.442
7	0.184	0.173	0.074	32	0.404
8	0.046	0.021	0.014	33	0.311
9	0.348	0.339	0.179	35	0.515
10	0.695	0.682	0.322	39	0.463
11	0.053	0.007	0.002	34	0.046
12	0.509	0.506	0.255	61	0.501
13	0.680	0.669	0.294	52	0.433
14	0.569	0.545	0.232	48	0.408
15	0.317	0.299	0.132	45	0.416
16	0.756	0.741	0.362	52	0.478
17	0.745	0.723	0.321	56	0.430
18	0.845	0.820	0.342	51	0.404
19	0.623	0.590	0.239	59	0.384
20	0.197	0.172	0.068	58	0.345
21	0.140	0.107	0.045	50	0.320
22	0.736	0.000	0.000	63	0.000
23	0.761	0.159	0.108	63	0.142
24	0.112	0.102	0.049	54	0.440
25	0.306	0.303	0.152	68	0.497
26	0.376	0.362	0.165	52	0.438
27	0.137	0.049	0.023	40	0.171
28	0.636	0.625	0.283	42	0.445
29	0.120	0.002	0.000	39	0.000
30	*	*	*	*	*
SUM	12.837	10.732	4.975	-	-
AVG	0.428	0.358	0.166	46	0.388
RESID	Q001		Q100		N100

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
STORAGE PERFORMANCE

SITE: ZEIN MECHANICAL-NO. 1 SOLAR/1057-79/04
REPORT PERIOD: APRIL,1979

DAY OF MONTH	ENERGY TO STORAGE MILLION BTU	ENERGY FROM STORAGE MILLION BTU	CHANGE IN STORED ENERGY MILLION BTU	STORAGE AVERAGE TEMP DEG F	STORAGE EFFICIENCY
1	0.026	0.187	-0.059	41	5.005
2	0.087	0.214	0.016	40	2.635
3	0.395	0.136	0.208	50	0.871
4	0.211	0.148	-0.011	58	0.650
5	0.009	0.253	-0.215	49	3.933
6	0.420	0.281	0.162	50	1.054
7	0.074	0.202	-0.099	48	1.388
8	0.014	0.178	-0.070	41	7.603
9	0.179	0.162	0.101	43	1.467
10	0.322	0.140	0.153	55	0.911
11	0.002	0.188	-0.222	50	-14.126
12	0.255	0.082	0.204	51	1.122
13	0.294	0.107	0.105	70	0.720
14	0.232	0.143	-0.054	70	0.382
15	0.132	0.136	-0.069	63	0.509
16	0.362	0.092	0.173	66	0.733
17	0.321	0.053	0.053	78	0.332
18	0.342	0.074	0.056	87	0.379
19	0.239	0.068	-0.074	86	-0.022
20	0.068	0.048	-0.160	79	-1.656
21	0.045	0.069	-0.053	68	0.353
22	0.000	0.038	-0.021	64	1.000
23	0.108	0.014	0.016	62	0.276
24	0.049	0.058	-0.003	65	1.118
25	0.152	0.026	0.061	65	0.573
26	0.165	0.098	0.035	72	0.805
27	0.023	0.136	-0.179	59	-1.810
28	0.283	0.123	0.200	59	1.139
29	0.000	0.119	-0.266	60	1.000
30	*	*	*	*	*
SUM	4.975	3.695	-0.013	-	-
AVG	0.166	0.123	-0.000	60	0.740
NBS ID	G200	G201	G202		N108

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SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SPACE HEATING SUBSYSTEM

SITE: ZEIN MECHANICAL-NO. 1
REPORT PERIOD: APRIL,1979

SOLAR/1057-79/04

DAY OF MON.	SPACE HEATING LOAD MILLION BTU	SOLAR FR.OF LOAD PCT	SOLAR ENERGY USED MILLION BTU	CREP ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	BLDG TEMP DEG. F	AMB TEMP DEG. F
1	0.289	65	0.187	0.064	0.102	0.102	N	0.144	N	67	33
2	0.328	65	0.214	0.072	0.114	0.114	O	0.165	O	67	32
3	0.219	62	0.136	0.051	0.083	0.083	T	0.102	T	68	36
4	0.229	64	0.148	0.051	0.081	0.081		0.113		68	36
5	0.445	57	0.253	0.073	0.192	0.192	A	0.202	A	66	31
6	0.527	53	0.281	0.087	0.246	0.246	P	0.222	P	65	23
7	0.306	66	0.202	0.065	0.104	0.104	P	0.158	P	67	29
8	0.277	64	0.178	0.062	0.098	0.098	L	0.136	L	67	32
9	0.255	63	0.162	0.059	0.093	0.093	I	0.122	I	67	32
10	0.220	64	0.140	0.050	0.080	0.080	C	0.106	C	68	33
11	0.286	66	0.188	0.061	0.098	0.098	A	0.146	A	67	35
12	0.133	62	0.082	0.032	0.051	0.051	B	0.060	B	68	53
13	0.170	63	0.107	0.039	0.063	0.063	L	0.079	L	68	48
14	0.220	65	0.143	0.047	0.077	0.077	E	0.110	E	68	44
15	0.212	64	0.136	0.047	0.076	0.076		0.104		68	42
16	0.147	63	0.092	0.034	0.054	0.054		0.069		68	44
17	0.089	60	0.053	0.022	0.036	0.036		0.038		69	46
18	0.112	66	0.074	0.023	0.038	0.038		0.057		69	44
19	0.104	66	0.068	0.022	0.036	0.036		0.053		69	49
20	0.082	58	0.048	0.021	0.034	0.034		0.033		69	54
21	0.111	62	0.069	0.026	0.043	0.043		0.051		69	49
22	0.069	55	0.038	0.021	0.031	0.031		0.024		69	54
23	0.052	27	0.014	0.028	0.038	0.038		-0.003		68	55
24	0.096	60	0.058	0.023	0.038	0.038		0.042		69	53
25	0.047	56	0.026	0.013	0.021	0.021		0.017		69	62
26	0.157	62	0.098	0.036	0.059	0.059		0.073		68	46
27	0.215	64	0.136	0.048	0.078	0.078		0.103		68	37
28	0.196	63	0.123	0.045	0.073	0.073		0.092		68	38
29	0.189	63	0.119	0.043	0.070	0.070		0.089		68	38
30	*	*	*	*	*	*		*		*	*
SUM	5.979	-	3.695	1.308	2.284	2.284	N.A.	2.799	N.A.	-	-
AVG	0.199	62	0.123	0.044	0.076	0.076	N.A.	0.093	N.A.	68	42
NBS	Q402	N400	Q400	Q403	Q401		Q410	Q415	Q417	N406	N113

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SPACE COOLING SUBSYSTEM

SITE: ZEIN MECHANICAL-NO. 1
REPORT PERIOD: APRIL,1979

SOLAR/1057-79/04

DAY OF MON.	SPACE COOLING LOAD MILLION BTU	SOLAR FR.OF LOAD PCT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	BLDG DRY BULB TEMP F	AMB TEMP DEG F
1	N	N	N	N	N	N	N	N	N	67	33
2	C	C	C	C	C	O	O	O	O	67	32
3	T	T	T	T	T	T	T	T	T	68	36
4										68	36
5	A	A	A	A	A	A	A	A	A	66	31
6	F	P	P	P	P	P	P	P	P	65	23
7	P	P	P	P	P	P	P	P	P	67	29
8	L	L	L	L	L	L	L	L	L	67	32
9	I	I	I	I	I	I	I	I	I	67	32
10	C	C	C	C	C	C	C	C	C	68	33
11	A	A	A	A	A	A	A	A	A	67	35
12	B	B	B	B	B	B	B	B	B	68	53
13	L	L	L	L	L	L	L	L	L	68	48
14	E	E	E	E	E	E	E	E	E	68	44
15										68	42
16										68	44
17										69	46
18										69	44
19										69	49
20										69	54
21										69	49
22										69	54
23										68	55
24										69	53
25										69	62
26										68	46
27										68	37
28										68	38
29										68	38
30										*	*
SUM	N.A.	-	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	-	-
AVG	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	68	42
NBS	Q502	N&CC	Q500	Q503	Q501		Q508	Q512	Q514	N406	N113

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SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENVIRONMENTAL SUMMARY

SITE: ZEIN MECHANICAL-NO. 1
REPORT PERIOD: APRIL,1979

SOLAR/1057-79/04

DAY OF MONTH	TOTAL INSOLATION BTU/SQ.FT	DIFFUSE INSOLATION BTU/SQ.FT	AMBIENT TEMPERATURE DEG F	DAYTIME AMBIENT TEMP DEG F	RELATIVE HUMIDITY PERCENT	WIND DIRECTION DEGREES	WIND SPEED M.P.H.
1	151	N	33	34	N	N	N
2	480	O	32	32	O	O	O
3	2090	T	36	44	T	T	T
4	1179		36	40			
5	189	A	31	38	A	A	A
6	2472	P	23	26	P	P	P
7	480	P	29	32	P	P	P
8	120	L	32	33	L	L	L
9	905	I	32	35	I	I	I
10	1811	C	33	39	C	C	C
11	137	A	35	34	A	A	A
12	1325	B	53	61	B	B	B
13	1770	L	48	52	L	L	L
14	1481	E	44	48	E	E	E
15	824		42	45			
16	1970		44	52			
17	1941		46	56			
18	2200		44	51			
19	1622		49	59			
20	513		54	58			
21	364		49	50			
22	1916		54	63			
23	1983		56	63			
24	291		53	54			
25	796		62	68			
26	980		46	52			
27	356		37	40			
28	1656		38	42			
29	314		38	39			
30	*		*	*			
SUM	33430	N.A.	-	-	-	-	-
AVG	1114	N.A.	42	46	N.A.	N.A.	N.A.
NBS ID	G001		N113			N115	N114

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& DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.